IN THE CLAIMS

Please amend the claims as follows:

Claims 1-37 (Canceled).

Claim 38 (Currently Amended): A method for measuring frequency characteristics of a direct current acceleration sensor, comprising:

supporting a metal rod with a center longitudinal axis thereof inclined at a prescribed angle to a direction of gravity acceleration,

impacting one of end surfaces of the metal rod with a projectile to generate and propagate an elastic wave pulse in the metal rod,

using a direct current acceleration sensor provided on the other of the end surfaces of the metal rod to detect an acceleration arising when the elastic wave pulse reflects at the other end surface of the metal rod,

using an optical measuring instrument to measure a velocity of motion of the other end surface of the metal rod arising when the elastic wave pulse reflects at the other end surface of the metal rod, and

obtaining from a signal from the direct current acceleration sensor and a signal from the optical measuring instrument a frequency response of the direct current acceleration sensor in a state in which the gravity acceleration affects the direct current acceleration sensor ~~and comparing data of said frequency response of the direct current acceleration sensor with data of the frequency response obtained by the method of claim 36~~, thereby obtaining characteristics with respect to the gravity acceleration in said frequency response of the direct current acceleration sensor.

Claim 39 (Canceled).

Claim 40 (Currently Amended): A method for measuring frequency characteristics of a direct current acceleration sensor, comprising:

supporting a metal rod with a center longitudinal axis thereof aligned with a direction of gravity acceleration,

releasing support of the metal rod to produce a free fall state,

during a period of releasing the support of the metal rod, impacting one of end surfaces of the metal rod with a projectile to generate and propagate an elastic wave pulse in the metal rod,

using a direct current acceleration sensor provided on the other of the end surfaces of the metal rod to detect an acceleration arising when the elastic wave pulse reflects at the other end surface of the metal rod,

using an optical measuring instrument to measure a velocity of motion of the other end surface of the metal rod arising when the elastic wave pulse reflects at the other end surface of the metal rod,

supporting the metal rod immediately after measuring the velocity of motion, and

obtaining a frequency response of the direct current acceleration sensor from a signal from the direct current acceleration sensor and a signal from the optical measuring instrument,

in which the one end surface of the metal rod is impacted with the projectile to generate the elastic wave pulse in the metal rod,

the method further comprising:

taking as an input signal to the direct current acceleration sensor provided on the other end surface of the metal rod dynamic displacement, velocity or acceleration in a direction

normal to the other end surface produced when the elastic wave pulse generated by the impact of the projectile reflects at the other end surface,

using the direct current acceleration sensor to detect, and the optical measuring instrument to directly measure, the input signal having time as a function,

carrying out signal processing with respect to an output signal from the direct current acceleration sensor and the output signal from the optical measuring instrument, and

using data that has been signal processed as a basis for measuring gain-frequency characteristics, phase-frequency characteristics and peak sensitivity of the direct current acceleration sensor in respect of each of dynamic displacement detection function, velocity detection function and acceleration detection function of the direct current acceleration sensor,

wherein the projectile that impacts the one end surface of the metal rod is composed of a plurality of round, concentric projectiles launched from a launch apparatus that includes multiple round, concentric launch tubes, in which the launch apparatus can precisely and independently control launch timing of each projectile launched.

Claims 41-52 (Canceled).

Claim 53 (Currently Amended): A method for measuring frequency characteristics of a direct current acceleration sensor ~~according to claim 43~~, comprising:

supporting a metal rod with a center longitudinal axis thereof aligned with a direction of gravity acceleration,

impacting one of end surfaces of the metal rod with a projectile to generate and propagate an elastic wave pulse in the metal rod,

using a direct current acceleration sensor provided on the other of the end surfaces of the metal rod to detect an acceleration arising when the elastic wave pulse reflects at the other end surface of the metal rod,

using an optical measuring instrument to measure a velocity of motion of the other end surface of the metal rod arising when the elastic wave pulse reflects at the other end surface of the metal rod, and

obtaining a frequency response of the direct current acceleration sensor from a signal from the direct current acceleration sensor and a signal from the optical measuring instrument,

in which the one end surface of the metal rod is impacted with the projectile to generate the elastic wave pulse in the metal rod,

the method further comprising:

taking as an input signal to the direct current acceleration sensor provided on the other end surface of the metal rod dynamic displacement, velocity or acceleration in a direction normal to the other end surface produced when the elastic wave pulse generated by the impact of the projectile reflects at the other end surface,

using the direct current acceleration sensor to detect, and the optical measuring instrument to directly measure, the input signal having time as a function,

carrying out signal processing with respect to an output signal from the direct current acceleration sensor and the output signal from the optical measuring instrument, and

using data that has been signal processed as a basis for measuring gain-frequency characteristics, phase-frequency characteristics and peak sensitivity of the direct current acceleration sensor in respect of each of dynamic displacement detection function, velocity detection function and acceleration detection function of the direct current acceleration sensor,

wherein the projectile that impacts the one end surface of the metal rod is composed of a plurality of round, concentric projectiles launched from a launch apparatus that includes multiple round, concentric launch tubes, in which the launch apparatus can precisely and independently control launch timing of each projectile launched.

Claims 54-55 (Canceled).

Claim 56 (Currently Amended): An apparatus for measuring frequency characteristics of a direct current acceleration sensor, comprising:

a metal rod support apparatus that supports a metal rod with a center longitudinal axis thereof aligned with a direction of gravity acceleration,

a launch apparatus for impacting one of end surfaces of a metal rod with a projectile to generate an elastic wave pulse in the metal rod,

a direct current acceleration sensor provided on the other of the end surfaces of the metal rod to detect an acceleration arising when the elastic wave pulse reflects at the other end surface of the metal rod,

an optical measuring instrument for measuring a velocity of motion of the other end surface of the metal rod arising when the elastic wave pulse reflects at the other end surface of the metal rod, and

a processor for calculating a frequency response of the direct current acceleration sensor from a signal from the direct current acceleration sensor and a signal from the optical measuring instrument,

wherein the projectile that impacts the one end surface of the metal rod is composed of a plurality of round, concentric projectiles launched from the launch apparatus that

includes multiple round, concentric launch tubes, and the launch apparatus can precisely and independently control launch timing of each projectile launched.

Claim 57 (Canceled).

Claim 58 (Currently Amended): An apparatus for measuring frequency characteristics of a direct current acceleration sensor, comprising:

a metal rod support apparatus that supports a metal rod with a center longitudinal axis thereof inclined at a prescribed angle to a direction of gravity acceleration,

a launch apparatus for impacting one of end surfaces of the metal rod with a projectile to generate an elastic wave pulse in the metal rod,

a direct current acceleration sensor provided on the other of the end surfaces of the metal rod to detect an acceleration arising when the elastic wave pulse reflects at the other end surface of the metal rod,

an optical measuring instrument for measuring a velocity of motion of the other end surface of the metal rod arising when the elastic wave pulse reflects at the other end surface of the metal rod, and

a processor that obtains a frequency response of the direct current acceleration sensor, with the direct current acceleration sensor affected by the gravity acceleration, from a signal from the direct current acceleration sensor and a signal from the optical measuring instrument to calculate characteristics with respect to gravity acceleration in said frequency response,

wherein the projectile that impacts the one end surface of the metal rod is composed of a plurality of round, concentric projectiles launched from the launch apparatus that includes multiple round, concentric launch tubes, and the launch apparatus can precisely and independently control launch timing of each projectile launched.

Claim 59 (Canceled).

Claim 60 (Currently Amended): An apparatus for measuring frequency characteristics of a direct current acceleration sensor, comprising:

a metal rod support apparatus that supports a metal rod with a center longitudinal axis thereof aligned with a direction of gravity acceleration, releases support of the metal rod to produce a free fall state and re-supports it after a prescribed time,

a launch apparatus that during a period of releasing the support of the metal rod impacts one of end surfaces of the metal rod with a projectile to generate an elastic wave pulse in the metal rod,

a direct current acceleration sensor provided on the other of the end surfaces of the metal rod to detect an acceleration arising when the elastic wave pulse reflects at the other end surface of the metal rod during the period of releasing the support of the metal rod,

an optical measuring instrument for measuring a velocity of motion of the other end surface of the metal rod arising when the elastic wave pulse reflects at the other end surface of the metal rod, and

a processor for calculating a frequency response of the direct current acceleration sensor from a signal from the direct current acceleration sensor and a signal from the optical measuring instrument,

wherein the projectile that impacts the one end surface of the metal rod is composed of a plurality of round, concentric projectiles launched from the launch apparatus that includes multiple round, concentric launch tubes, and the launch apparatus can precisely and independently control launch timing of each projectile launched.

Claims 61-74 (Canceled).

Claim 75 (Currently Amended): An apparatus for measuring frequency characteristics of a direct current acceleration sensor according to ~~claim 71~~ any one of claims 56, 58, and 60, wherein the one end surface of the metal rod contacts a metal ball and the launch apparatus that launches a plurality of projectiles in a concentric circle from the multiple launch tubes precisely controls launch timing with respect to said metal ball to generate an elastic wave pulse in the metal rod.

Claims 76-79 (Canceled).

Claim 80 (New): An apparatus for measuring frequency characteristics of a direct current acceleration sensor, comprising:

a metal rod support apparatus that supports a metal rod with a center longitudinal axis thereof aligned with a direction of gravity acceleration,

a launch apparatus for impacting one of end surfaces of a metal rod with a projectile to generate an elastic wave pulse in the metal rod,

a direct current acceleration sensor provided on the other of the end surfaces of the metal rod to detect an acceleration arising when the elastic wave pulse reflects at the other end surface of the metal rod,

an optical measuring instrument for measuring a velocity of motion of the other end surface of the metal rod arising when the elastic wave pulse reflects at the other end surface of the metal rod, and

a processor for calculating a frequency response of the direct current acceleration sensor from a signal from the direct current acceleration sensor and a signal from the optical measuring instrument,

wherein the projectile has a structure that is a lamination of different materials to control a frequency band of the elastic wave pulse generated in the metal rod by the impact of the projectile.

Claim 81 (New): An apparatus for measuring frequency characteristics of a direct current acceleration sensor, comprising:

a metal rod support apparatus that supports a metal rod with a center longitudinal axis thereof inclined at a prescribed angle to a direction of gravity acceleration,

a launch apparatus for impacting one of end surfaces of the metal rod with a projectile to generate an elastic wave pulse in the metal rod,

a direct current acceleration sensor provided on the other of the end surfaces of the metal rod to detect an acceleration arising when the elastic wave pulse reflects at the other end surface of the metal rod,

an optical measuring instrument for measuring a velocity of motion of the other end surface of the metal rod arising when the elastic wave pulse reflects at the other end surface of the metal rod, and

a processor that obtains a frequency response of the direct current acceleration sensor, with the direct current acceleration sensor affected by the gravity acceleration, from a signal from the direct current acceleration sensor and a signal from the optical measuring instrument to calculate characteristics with respect to gravity acceleration in said frequency response,

wherein the projectile has a structure that is a lamination of different materials to control a frequency band of the elastic wave pulse generated in the metal rod by the impact of the projectile.

Claim 82 (New): An apparatus for measuring frequency characteristics of a direct current acceleration sensor, comprising:

a metal rod support apparatus that supports a metal rod with a center longitudinal axis thereof aligned with a direction of gravity acceleration, releases support of the metal rod to produce a free fall state and re-supports it after a prescribed time,

a launch apparatus that during a period of releasing the support of the metal rod impacts one of end surfaces of the metal rod with a projectile to generate an elastic wave pulse in the metal rod,

a direct current acceleration sensor provided on the other of the end surfaces of the metal rod to detect an acceleration arising when the elastic wave pulse reflects at the other end surface of the metal rod during the period of releasing the support of the metal rod,

an optical measuring instrument for measuring a velocity of motion of the other end surface of the metal rod arising when the elastic wave pulse reflects at the other end surface of the metal rod, and

a processor for calculating a frequency response of the direct current acceleration sensor from a signal from the direct current acceleration sensor and a signal from the optical measuring instrument,

wherein the projectile has a structure that is a lamination of different materials to control a frequency band of the elastic wave pulse generated in the metal rod by the impact of the projectile.

Claim 83 (New): An apparatus for measuring frequency characteristics of a direct current acceleration sensor, comprising:

a metal rod support apparatus that supports a metal rod with a center longitudinal axis thereof aligned with a direction of gravity acceleration,

a launch apparatus for impacting one of end surfaces of a metal rod with a projectile to generate an elastic wave pulse in the metal rod,

a direct current acceleration sensor provided on the other of the end surfaces of the metal rod to detect an acceleration arising when the elastic wave pulse reflects at the other end surface of the metal rod,

an optical measuring instrument for measuring a velocity of motion of the other end surface of the metal rod arising when the elastic wave pulse reflects at the other end surface of the metal rod, and

a processor for calculating a frequency response of the direct current acceleration sensor from a signal from the direct current acceleration sensor and a signal from the optical measuring instrument,

wherein in accordance with a theoretical propagation of the elastic wave in the metal rod, when obtaining transient signal distortion of an elastic wave pulse from the strain gauge output signal incident on the one end surface, at least a primary term of a series-expanded Skalak's analytic solution is used.

Claim 84 (New): An apparatus for measuring frequency characteristics of a direct current acceleration sensor, comprising:

a metal rod support apparatus that supports a metal rod with a center longitudinal axis thereof inclined at a prescribed angle to a direction of gravity acceleration,

a launch apparatus for impacting one of end surfaces of the metal rod with a projectile to generate an elastic wave pulse in the metal rod,

a direct current acceleration sensor provided on the other of the end surfaces of the metal rod to detect an acceleration arising when the elastic wave pulse reflects at the other end surface of the metal rod,

an optical measuring instrument for measuring a velocity of motion of the other end surface of the metal rod arising when the elastic wave pulse reflects at the other end surface of the metal rod, and

a processor that obtains a frequency response of the direct current acceleration sensor, with the direct current acceleration sensor affected by the gravity acceleration, from a signal from the direct current acceleration sensor and a signal from the optical measuring instrument to calculate characteristics with respect to gravity acceleration in said frequency response,

wherein in accordance with a theoretical propagation of the elastic wave in the metal rod, when obtaining transient signal distortion of an elastic wave pulse from the strain gauge output signal incident on the one end surface, at least a primary term of a series-expanded Skalak's analytic solution is used.

Claim 85 (New): An apparatus for measuring frequency characteristics of a direct current acceleration sensor, comprising:

a metal rod support apparatus that supports a metal rod with a center longitudinal axis thereof aligned with a direction of gravity acceleration, releases support of the metal rod to produce a free fall state and re-supports it after a prescribed time,

a launch apparatus that during a period of releasing the support of the metal rod impacts one of end surfaces of the metal rod with a projectile to generate an elastic wave pulse in the metal rod,

a direct current acceleration sensor provided on the other of the end surfaces of the metal rod to detect an acceleration arising when the elastic wave pulse reflects at the other end surface of the metal rod during the period of releasing the support of the metal rod,

an optical measuring instrument for measuring a velocity of motion of the other end surface of the metal rod arising when the elastic wave pulse reflects at the other end surface of the metal rod, and

a processor for calculating a frequency response of the direct current acceleration sensor from a signal from the direct current acceleration sensor and a signal from the optical measuring instrument,

wherein in accordance with a theoretical propagation of the elastic wave in the metal rod, when obtaining transient signal distortion of an elastic wave pulse from the strain gauge output signal incident on the one end surface, at least a primary term of a series-expanded Skalak's analytic solution is used.

Claim 86 (New): An apparatus for measuring frequency characteristics of a direct current acceleration sensor, comprising:

a metal rod support apparatus that supports a metal rod with a center longitudinal axis thereof aligned with a direction of gravity acceleration,

a launch apparatus for impacting one of end surfaces of a metal rod with a projectile to generate an elastic wave pulse in the metal rod,

a direct current acceleration sensor provided on the other of the end surfaces of the metal rod to detect an acceleration arising when the elastic wave pulse reflects at the other end surface of the metal rod,

an optical measuring instrument for measuring a velocity of motion of the other end surface of the metal rod arising when the elastic wave pulse reflects at the other end surface of the metal rod, and

a processor for calculating a frequency response of the direct current acceleration sensor from a signal from the direct current acceleration sensor and a signal from the optical measuring instrument,

wherein in accordance with a theoretical propagation of the elastic wave in the metal rod, when obtaining transient signal distortion of an elastic wave pulse from the strain gauge output signal incident on the one end surface, up to a high-order term of a series-expanded Skalak's analytic solution is used.

Claim 87 (New): An apparatus for measuring frequency characteristics of a direct current acceleration sensor, comprising:

a metal rod support apparatus that supports a metal rod with a center longitudinal axis thereof inclined at a prescribed angle to a direction of gravity acceleration,

a launch apparatus for impacting one of end surfaces of the metal rod with a projectile to generate an elastic wave pulse in the metal rod,

a direct current acceleration sensor provided on the other of the end surfaces of the metal rod to detect an acceleration arising when the elastic wave pulse reflects at the other end surface of the metal rod,

an optical measuring instrument for measuring a velocity of motion of the other end surface of the metal rod arising when the elastic wave pulse reflects at the other end surface of the metal rod, and

a processor that obtains a frequency response of the direct current acceleration sensor, with the direct current acceleration sensor affected by the gravity acceleration, from a signal

from the direct current acceleration sensor and a signal from the optical measuring instrument to calculate characteristics with respect to gravity acceleration in said frequency response,

wherein in accordance with a theoretical propagation of the elastic wave in the metal rod, when obtaining transient signal distortion of an elastic wave pulse from the strain gauge output signal incident on the one end surface, up to a high-order term of a series-expanded Skalak's analytic solution is used.

Claim 88 (New): An apparatus for measuring frequency characteristics of a direct current acceleration sensor, comprising:

a metal rod support apparatus that supports a metal rod with a center longitudinal axis thereof aligned with a direction of gravity acceleration, releases support of the metal rod to produce a free fall state and re-supports it after a prescribed time,

a launch apparatus that during a period of releasing the support of the metal rod impacts one of end surfaces of the metal rod with a projectile to generate an elastic wave pulse in the metal rod,

a direct current acceleration sensor provided on the other of the end surfaces of the metal rod to detect an acceleration arising when the elastic wave pulse reflects at the other end surface of the metal rod during the period of releasing the support of the metal rod,

an optical measuring instrument for measuring a velocity of motion of the other end surface of the metal rod arising when the elastic wave pulse reflects at the other end surface of the metal rod, and

a processor for calculating a frequency response of the direct current acceleration sensor from a signal from the direct current acceleration sensor and a signal from the optical measuring instrument,

wherein in accordance with a theoretical propagation of the elastic wave in the metal rod, when obtaining transient signal distortion of an elastic wave pulse from the strain gauge output signal incident on the one end surface, up to a high-order term of a series-expanded Skalak's analytic solution is used.

Claim 89 (New): An apparatus for measuring frequency characteristics of a direct current acceleration sensor, comprising:

a metal rod support apparatus that supports a metal rod with a center longitudinal axis thereof aligned with a direction of gravity acceleration,

a launch apparatus for impacting one of end surfaces of a metal rod with a projectile to generate an elastic wave pulse in the metal rod,

a direct current acceleration sensor provided on the other of the end surfaces of the metal rod to detect an acceleration arising when the elastic wave pulse reflects at the other end surface of the metal rod,

an optical measuring instrument for measuring a velocity of motion of the other end surface of the metal rod arising when the elastic wave pulse reflects at the other end surface of the metal rod, and

a processor for calculating a frequency response of the direct current acceleration sensor from a signal from the direct current acceleration sensor and a signal from the optical measuring instrument,

wherein the direct current acceleration sensor has a peak sensitivity determined in accordance with an input acceleration waveform and frequency band produced by a plurality of projectiles launched from the launch apparatus with precisely controlled launch timing.

Claim 90 (New): An apparatus for measuring frequency characteristics of a direct current acceleration sensor, comprising:

a metal rod support apparatus that supports a metal rod with a center longitudinal axis thereof inclined at a prescribed angle to a direction of gravity acceleration,

a launch apparatus for impacting one of end surfaces of the metal rod with a projectile to generate an elastic wave pulse in the metal rod,

a direct current acceleration sensor provided on the other of the end surfaces of the metal rod to detect an acceleration arising when the elastic wave pulse reflects at the other end surface of the metal rod,

an optical measuring instrument for measuring a velocity of motion of the other end surface of the metal rod arising when the elastic wave pulse reflects at the other end surface of the metal rod, and

a processor that obtains a frequency response of the direct current acceleration sensor, with the direct current acceleration sensor affected by the gravity acceleration, from a signal from the direct current acceleration sensor and a signal from the optical measuring instrument to calculate characteristics with respect to gravity acceleration in said frequency response,

wherein the direct current acceleration sensor has a peak sensitivity determined in accordance with an input acceleration waveform and frequency band produced by a plurality of projectiles launched from the launch apparatus with precisely controlled launch timing.

Claim 91 (New): An apparatus for measuring frequency characteristics of a direct current acceleration sensor, comprising:

a metal rod support apparatus that supports a metal rod with a center longitudinal axis thereof aligned with a direction of gravity acceleration, releases support of the metal rod to produce a free fall state and re-supports it after a prescribed time,

a launch apparatus that during a period of releasing the support of the metal rod impacts one of end surfaces of the metal rod with a projectile to generate an elastic wave pulse in the metal rod,

a direct current acceleration sensor provided on the other of the end surfaces of the metal rod to detect an acceleration arising when the elastic wave pulse reflects at the other end surface of the metal rod during the period of releasing the support of the metal rod,

an optical measuring instrument for measuring a velocity of motion of the other end surface of the metal rod arising when the elastic wave pulse reflects at the other end surface of the metal rod, and

a processor for calculating a frequency response of the direct current acceleration sensor from a signal from the direct current acceleration sensor and a signal from the optical measuring instrument,

wherein the direct current acceleration sensor has a peak sensitivity determined in accordance with an input acceleration waveform and frequency band produced by a plurality of projectiles launched from the launch apparatus with precisely controlled launch timing.